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Psychotherapies for depression in low- and middle-income countries: a meta-analysis

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Most psychotherapies for depression have been developed in high-income Western countries of North America, Europe and Australia. A growing number of randomized trials have examined the effects of these treatments in non-Western countries. We conducted a meta-analysis of these studies to examine whether these psychotherapies are effective and to compare their effects between studies from Western and non-Western countries. We conducted systematic searches in bibliographical databases and included 253 randomized controlled trials, of which 32 were conducted in non-Western countries. The effects of psychotherapies in non-Western countries were large (g=1.10; 95% CI: 0.91-1.30), with high heterogeneity (I^2=90; 95% CI: 87-92). After adjustment for publication bias, the effect size dropped to g=0.73 (95% CI: 0.51-0.96). Subgroup analyses did not indicate that adaptation to the local situation was associated with the effect size. Comparisons with the studies in Western countries showed that the effects of the therapies were significantly larger in non-Western countries, also after adjusting for characteristics of the participants, the treatments and the studies. These larger effect sizes in non-Western countries may reflect true differences indicating that therapies are indeed more effective; or may be explained by the care-as-usual control conditions in non-Western countries, often indicating that no care was available; or may be the result of the relative low quality of many trials in the field. This study suggests that psychotherapies that were developed in Western countries may or may not be more effective in non-Western countries, but they are probably no less effective and can therefore also be used in these latter countries.

Key words: Depression, psychotherapy, low- and middle-income countries, care-as-usual, meta-analysis

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Depression and other common mental disorders are highly prevalent, with almost one in five people worldwide affected[1,2]. They have a considerable impact on the lives of patients and their families, and are associated with huge economic and societal costs[3]. The disability associated with these disorders results in a loss of more than one million healthy life years, which makes mental disorders the leading cause of years lived with disability worldwide[4]. The economic costs, in terms of production losses and health and social care expenditures, have been estimated at US$2.5 trillion in 2010 worldwide[5-7], and these costs are expected to grow to US$6.0 trillion by 2030[8].

Several evidence-based pharmacotherapies and psychotherapies are available for depression. However, most people with a depressive disorder do not receive treatment, especially in low- and middle-income countries, where only between 7 and 21% of patients are treated[5]. If patients get treatment, this typically consists of pharmacotherapy, while the majority of patients prefer psychotherapies[9].

Several psychotherapies, such as cognitive behavior therapy, interpersonal psychotherapy, problem-solving and behavioral activation, have been developed for the treatment of depression[10]. Since the 1970s, several hundreds of randomized trials have shown that these interventions are effective[11-14], although their effects are modest and have been overestimated because of the low quality of many trials[15] and publication bias[16,17]. The effects of psychotherapies have been found to be comparable to those of pharmacotherapy[18], and probably last longer[19].

Most psychotherapies have been developed in high-income Western countries in North America, Europe and Australia, and the vast majority of the more than 450 randomized trials which have examined their effects[20] have been conducted in those countries. It is therefore not well known whether these therapies are also effective in low- and middle-income countries.

In recent years, a growing number of randomized trials have examined the effects of psychotherapies for depression in countries outside of North America, Europe and Australia. The goal of the present meta-analysis is to examine whether these psychotherapies are also effective in non-Western countries and to compare their effects with those in Western countries. This also gives the opportunity to examine whether the effects of psychotherapies are associated with the income of the country and the region where the trial was conducted.

METHODS

Identification and selection of studies

We used an existing database of studies on psychotherapies for depression. This database has been described in detail elsewhere[20], has been used in a series of earlier published meta-analyses[21], and is continuously updated. For this database we searched four major bibliographical sources (PubMed, PsycINFO, Embase and the Cochrane Library) by combining terms (both index terms and text words) indicative of depression and

psychotherapies, with filters for randomized controlled trials. We also checked the references of earlier meta-analyses.

Because this database was not developed specifically to include studies from non-Western countries, we examined the list produced by the Effective Practice and Organization of Care (EPOC) Group (a Cochrane review group), which contains a collection of databases, websites and journals relevant to low- and middle-income countries. We selected databases that were freely available, could be searched in English, and had a working web address. The following databases were searched with adapted search strings: the International Initiative for Impact Evaluation (3ie); the British Library for Development Studies; the Eldis; the World Health Organization (WHO)'s Global Index Medicus; the Latin-American and Caribbean System on Health Sciences Information (LILACS); the Indice Bibliográfico Español de Ciencias de la Salud (IBECS); the AfricaBib; the IndMed; the KoreaMed; and African Journals Online. The search was made in November 2016.

All records were screened by two independent researchers and all papers that could possibly meet inclusion criteria according to one of the researchers were retrieved as full text. The decision to include or exclude a study was also done by the two independent researchers, and disagreements were solved through discussion.

We included papers reporting on a randomized trial in which a psychotherapy for adult depression was compared with a control group (waiting list, care-as-usual, placebo, other inactive treatment) in a non-Western country (not located in North America, Europe or Australia).

Depression could be established by a diagnostic interview or a score above a cut-off on a self-report scale. Psychotherapies were defined as interventions with a primary focus on language-based communication between a patient and a therapist, or as bibliotherapy supported by a therapist[22]. The therapies could be delivered individually, in groups, or as guided self-help by professionals or para-professionals. Comorbid mental or somatic disorders were not used as an exclusion criterion. Studies on inpatients were excluded. We also excluded maintenance studies aimed at people who had already recovered or partly recovered after an earlier treatment.

In addition to the main analyses of the studies conducted in non-Western countries, we also compared treatment effect sizes in the trials conducted in non-Western countries with those conducted in Western countries. For this comparison, we selected from our database trials on psychotherapies for depression that were conducted in Western countries and in which psychotherapy was compared with a control condition, with the same inclusion and exclusion criteria as for the studies in non-Western countries.

Quality assessment and data extraction

We assessed the quality of included studies using four criteria of the "Risk of bias" assessment tool, developed by the Cochrane Collaboration[23]. This tool assesses possible sources of bias in randomized trials, including the adequate generation of allocation sequence; the concealment of allocation to conditions; the prevention of knowledge of the allocated intervention (masking of assessors); and dealing with incomplete outcome data (this was assessed as positive when intention-to-treat analyses were conducted, meaning that all randomized patients were included in the analyses). Assessment of the quality of the included studies was conducted by two independent researchers, and disagreements were solved through discussion.

We also coded participant characteristics (depressive disorder or scoring high on a self-rating scale; recruitment method; target group); characteristics of the psychotherapies (treatment format; number of sessions); and general characteristics of the studies (type of control group; country where the study was conducted).

We rated whether the intervention was adapted to the local setting and population. We considered an intervention not adapted when the authors did not mention adaptation and when the procedures described were comparable to those found in therapies developed in Western countries. An intervention was considered as adapted when it was explicitly mentioned that it was adapted to the local situation. We considered an intervention also as "adapted" when it was developed in a non-Western country and was based on models or theories from non-Western countries. We also considered an intervention as "not adapted" when Western manuals were just translated into the national language.

In order to examine whether the effects of psychotherapy were associated with the per capita income, we recorded the gross national income (GNI) based on purchasing power parity (PPP) per capita in international dollars for each of the countries where a trial was conducted, using data from the World Bank (http://data.worldbank.org). We categorized the countries into low-, lower-middle, upper-middle and high-income ones according to the definition of the World Bank. We also used the six World Bank regions to categorize where the studies were conducted (East Asia and Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, and Sub-Saharan Africa).

Primary outcome

For each comparison between a psychotherapy and a control condition, the effect size indicating the difference between the two groups at post-test was calculated (Hedges' g). Effect sizes of 0.8 can be assumed to be large, while effect sizes of 0.5 are moderate, and effect sizes of 0.2 are small[24]. Effect sizes were calculated by subtracting (at post-test) the average score of the psychotherapy group from the average score of the control group, and dividing the result by the pooled standard deviation. Because some studies had relatively small sample sizes, we corrected the effect size for small sample bias[25]. If means and standard deviations were not reported, we used the procedures of the Comprehensive Meta-Analysis software (see

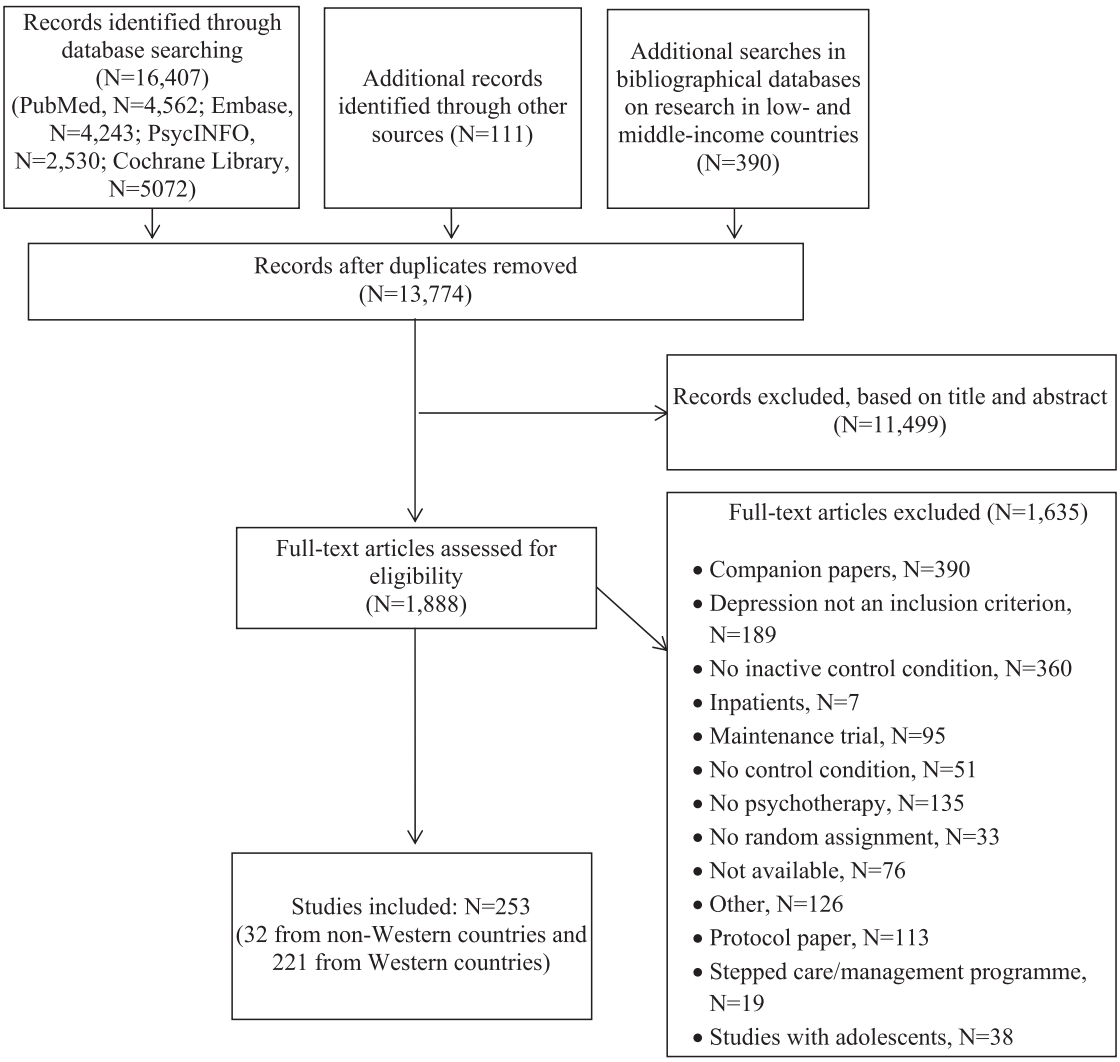

Figure 1 PRISMA flow chart

below) to calculate the effect size using dichotomous outcomes; and if these were not available either, we used other statistics (such as t or p value) to calculate the effect size.

In order to calculate effect sizes, we used all measures examining depressive symptoms, such as the Beck Depression Inventory (BDI-I or BDI-II)[26,27] or the Hamilton Rating Scale for Depression (HAMD-17)[28].

Meta-analyses

To calculate pooled mean effect sizes, we used the computer program Comprehensive Meta-Analysis (version 3.3070). Because we expected considerable heterogeneity among the studies, we employed a random effects pooling model in all analyses.

Numbers-needed-to-be-treated (NNT) were calculated using the formulae provided by Furukawa[29], in which the control group's event rate was set at a conservative 19% (based on the pooled response rate of 50% reduction of symptoms across trials in psychotherapies for depression)[30]. As a test of homogeneity of effect sizes, we calculated the I^2 statistic, which is an indicator of heterogeneity in percentages. A value of 0% indicates no observed heterogeneity, and larger values indicate increasing heterogeneity, with 25% as low, 50% as moderate, and 75% as high heterogeneity[31]. We calculated 95% confidence intervals (CIs) around I^2 using the non-central chi-squared-based approach within the heterogi module for Stata[32,33]. We conducted sensitivity analyses excluding potential outliers. These were defined as studies in which the 95% CI of the effect size did not overlap with the 95% CI of the pooled effect size.

We conducted subgroup analyses according to the mixed effects model, in which studies within subgroups are pooled with the random effects model, while tests for significant differences between subgroups are conducted with the fixed effects model. For continuous variables, we used meta-regression analyses to test whether there was a significant relationship between the continuous variable and effect size, as indicated by a z value and an associated p value. Multivariate meta-regression anal-

Table 1 Selected characteristics of randomized trials comparing psychotherapies for adult depression to control groups in non-Western countries

Study	Conditions	N patients	Format	Cultural adaptation	N sessions	Country	Risk of bias*
Bolton et al[35]	IPT	139	Group	Adapted	16	Uganda	+ – SR +
	CAU	145					
Chan et al[36]	CBT	17	Individual	Not adapted	10	China	– + + –
	MBCT	17	Individual	Non-Western	10		
	WL	16					
Chan et al[37]	Other	14	Individual	Non-Western	5	China	+ – SR +
	CAU	12					
Chen et al[38]	SUP	30	Group	Not adapted	4	Taiwan	– – SR –
	CAU	30					
Chiang et al[39]	CBT	30	Group	Not adapted	12	Taiwan	+ + + –
	CAU	32					
Cho et al[40]	CBT	12	Individual	Not adapted	9	Korea	– – SR –
	CAU	10					
Duarte et al[41]	CBT	41	Group	Not adapted	12	Brazil	– + SR –
	CAU	44					
Faramarzi et al[42]	CBT	29	Group	Not adapted	10	Iran	– – SR –
	CAU	30					
Furukawa et al[43]	CBT	58	Individual	Adapted	8	Japan	+ + SR +
	WL	60					
García-Peña et al[44]	CBT	41	Group	Not adapted	12	Mexico	+ – SR –
	CAU	40					
Hamdan-Mansour et al[45]	CBT	44	Group	Adapted	10	Jordan	– + SR –
	CAU	36					
Hou et al[46]	CBT	104	Individual	Not adapted	19	China	– – SR –
	CAU	109					
Huang et al[47]	CBT	31	Group	Not adapted	12	Taiwan	– – SR –
	CAU	30					
Jiang et al[48]	Other	257	Individual	Not adapted	–	China	+ – SR –
	CAU	514					
Leung et al[49]	CBT	47	Group	Adapted	6	China	– – SR +
	CAU	50					
Liu et al[50]	CBT	27	Guided self-help	Not adapted	10	Taiwan	– – SR –
	WL	25					
Mukhtar[51]	CBT	58	Group	Adapted	8	Malaysia	– – SR –
	WL	55					
Naeem et al[52]	CBT	94	Guided self-help	Adapted	7	Pakistan	+ – SR –
	CAU	89					
Nakimuli-Mpungu et al[53]	SUP	57	Group	Adapted	8	Uganda	+ + SR +
	Other	52					
Ng et al[54]	Other	14	Individual	Not adapted	5	Singapore	– – SR –
	CAU	12					
Ngai et al[55]	CBT	197	Other	Adapted	5	China	+ + SR +
	CAU	200					

Table 1 Selected characteristics of randomized trials comparing psychotherapies for adult depression to control groups in non-Western countries *(continued)*

Study	Conditions	N patients	Format	Cultural adaptation	N sessions	Country	Risk of bias*
Omidi et al[56]	CBT	30	Group	Not adapted	8	Iran	– – SR –
	MBCT	30	Group	Not adapted	8		
	CAU	30					
Petersen et al[57]	IPT	17	Group	Adapted	8	South Africa	+ – SR –
	CAU	17					
Qiu et al[58]	CBT	31	Group	Not adapted	10	China	+ + + +
	WL	31					
Rahman et al[59]	CBT	418	Individual	Adapted	16	Pakistan	+ + + –
	Other	400					
Songprakun & McCann[60]	CBT	26	Guided self-help	Not adapted	8	Thailand	+ + + –
	CAU	28					
Sreevani et al[61]	Other	15	Group	Non-Western	4	India	+ – SR –
	CAU	15					
Teichman et al[62]	CMT	15	Individual	Not adapted	13	Israel	– – SR –
	CBT	15	Individual	Not adapted	13		
	WL	15					
Vitriol et al[63]	DYN	44	Individual	Not adapted	12	Chile	– – + +
	CAU	43					
Wong[64]	CBT	48	Group	Adapted	10	China	– + SR +
	WL	40					
Wong[65]	CBT	163	Group	Adapted	10	China	– + SR –
	WL	159					
Zu et al[66]	CBT	12	Individual	Not adapted	20	China	+ – + –
	CAU	16					

CAU – care as usual, CBT – cognitive behavior therapy, CMT – cognitive marital therapy, CT – cognitive therapy, DR – psychodrama, DYN – psychodynamic therapy, IPT – interpersonal psychotherapy, MBCT – mindfulness based cognitive therapy, SUP – non-directive supportive therapy
*A positive (+) or negative (−) sign is given for four quality criteria: allocation sequence, concealment of allocation to conditions, blinding of assessors, and intention-to-treat analyses; SR indicates that only self-report measures (and no assessor) were used

yses, with the effect size as the dependent variable, were conducted through Comprehensive Meta-Analysis.

We tested for publication bias by inspecting the funnel plot on primary outcome measures and by Duval and Tweedie's trim and fill procedure[34], which yields an estimate of the effect size after the publication bias has been taken into account (as implemented in Comprehensive Meta-Analysis). We also conducted Egger's test of the intercept to quantify the bias captured by the funnel plot and to test whether it was significant.

RESULTS

Selection and inclusion of studies

After examining a total of 16,908 abstracts (13,774 after removal of duplicates), we retrieved 1,888 full-text papers for further consideration. We excluded 1,635 of the retrieved papers. The PRISMA flow chart describing the inclusion process, with the reasons for exclusion, is presented in Figure 1.

A total of 32 studies conducted in non-Western countries (with 35 comparisons between a psychotherapy and a control condition) met inclusion criteria for this meta-analysis (Table 1). Another 221 studies (with 297 comparisons between a treatment and a control group) on psychotherapies in Western countries were included (for the comparison of effect sizes in Western versus non-Western countries). This makes a total of 253 studies that were included in the analyses.

Characteristics of included studies

In the 32 included studies conducted in Non-Western countries, a total of 4,607 patients participated (2,222 for therapy conditions and 2,385 for control conditions). Participants were

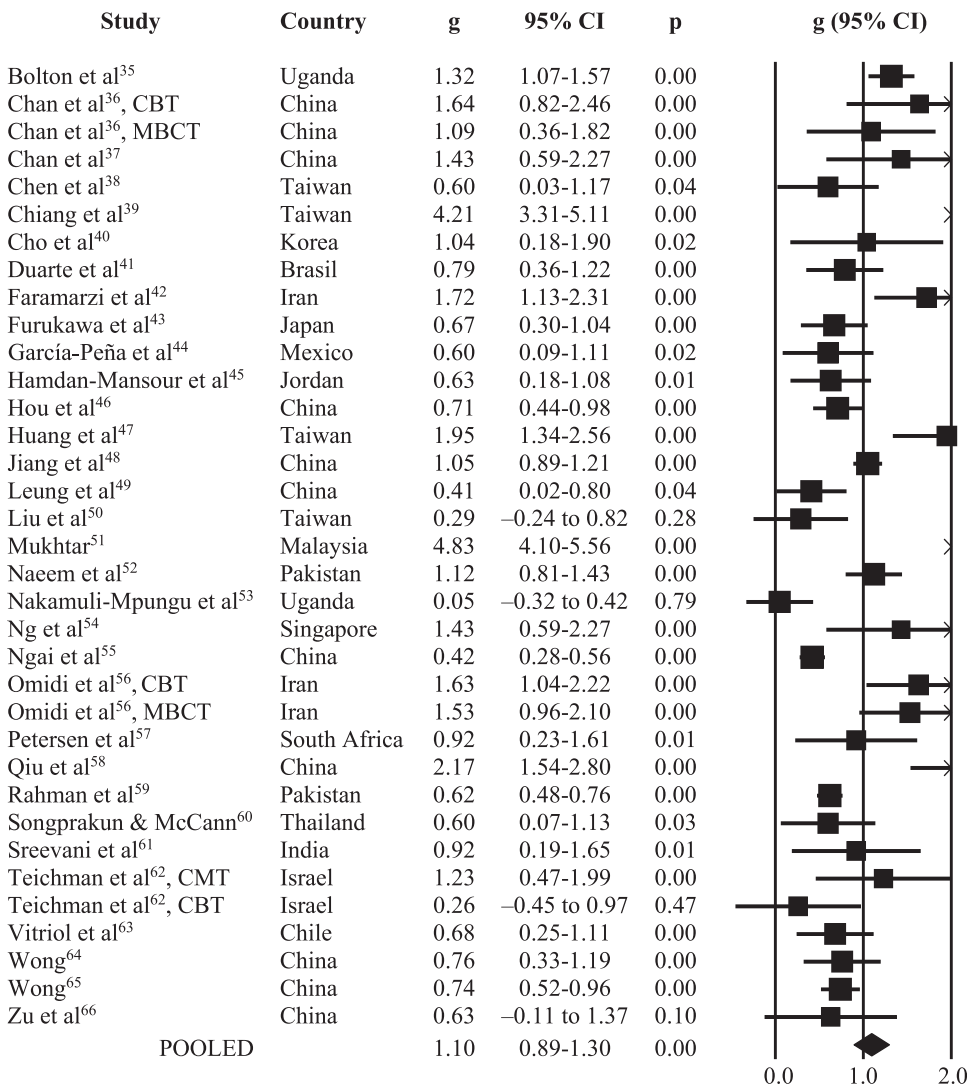

Figure 2 Forest plot of effect sizes from randomized controlled trials of psychotherapies for depression in Non-Western countries. CBT – cognitive behavior therapy, MBCT – mindfulness based cognitive therapy, DR – psychodrama, CMT – cognitive marital therapy

recruited through announcements in local newspapers and other media (four studies), referrals from health services (11 studies), or other strategies such as screening at general medical services (17 studies).

In 25 of the 35 comparisons between a treatment and a control condition, cognitive behavior therapy was used as the intervention. Two studies used interpersonal psychotherapy, one used psychodynamic therapy, one used non-directive supportive therapy, and the remaining six used another type of treatment. Of these treatments, 12 were culturally adapted, 20 were not culturally adapted, and three were non-Western treatments. Eighteen comparisons used a group treatment format, 13 utilized individual treatment, and three used a guided self-help treatment format. The number of treatment sessions ranged from four to 20. Eight studies used a waiting list as control group, 22 studies used care-as-usual, and two used another control group.

Nineteen studies were conducted in East Asia, three in South Asia, three in Latin America and the Caribbean, four in the Middle East and North Africa, and three in Sub-Saharan Africa. The gross national income of the countries ranged from low/low-medium (250 US$) to high (54,580 US$).

Effects of psychotherapies in non-Western countries

The overall effect in the 35 comparisons between psychotherapies and control groups was g=1.10 (95% CI: 0.91-1.30), which corresponds with a NNT of 2.51. Heterogeneity was very high (I^2=90; 95% CI: 87-92). Effect sizes and 95% confidence intervals of each study are presented in the forest plot in Figure 2. The results of these main analyses are presented in Table 2.

Considering only the outcomes measured with the HAM-D-17, the mean effect size was g=1.38 (95% CI: 0.66-2.09; n=7;

Table 2 Psychotherapies for adult depression in non-Western countries compared with control conditions

		N	g	95% CI	I^2	95% CI	p	NNT
All comparisons		35	1.10	0.91-1.30	90	87-92		2.51
One effect size per study (highest only)		32	1.11	0.90-1.32	90	88-92		2.49
One effect size per study (lowest only)		32	1.06	0.85-1.27	90	88-92		2.62
Outliers excluded		26	0.95	0.82-1.08	55	23-70		2.95
Extreme positive outliers excluded		32	0.87	0.73-1.06	78	69-83		3.26
Only HAM-D		7	1.38	0.66-2.09	93	89-95		1.99
Only BDI-I		9	1.33	0.54-2.12	93	90-95		2.06
Only BDI-II		7	1.37	0.76-1.97	91	85-94		2.01
Adjusted for publication bias (9 imputed)		44	0.73	0.51-0.96	93	92-94		3.98
Subgroup analyses								
Region	East Asia	17	0.83	0.64-1.02	77	61-84	0.55	3.44
	Middle East and North Africa	6	1.17	0.69-1.65	74	18-87		2.35
	South Asia	3	0.86	0.47-1.25	77	0-91		3.30
	Other	6	0.73	0.30-1.16	85	64-91		3.98
Income level of country	High	8	0.86	0.48-1.23	71	24-84	0.95	3.30
	Upper middle	18	0.89	0.71-1.08	77	63-84		3.18
	Low/lower middle	6	0.83	0.44-1.22	88	76-93		3.44
Risk of bias	0-1 (high)	10	1.20	0.84-1.56	73	42-84	<0.001	2.29
	2-3	16	0.87	0.70-1.03	61	22-76		3.26
	4 (low)	6	0.51	0.34-0.69	60	0-82		6.01
Control group	Care as usual	22	0.97	0.78-1.16	80	71-86	0.02	2.88
	Waiting list/other	10	0.65	0.45-0.85	61	0-79		4.55
Target group	Adults	15	0.95	0.74-1.16	65	32-79	0.16	2.95
	Perinatal depression	7	0.67	0.44-0.90	84	67-91		4.39
	Other	10	0.97	0.60-1.35	80	60-88		2.88
Diagnosis	Depressive disorder	21	0.91	0.74-1.09	74	57-82	0.48	3.02
	Cut-off on scale	11	0.80	0.53-1.07	84	72-89		3.58
Adaptation	Yes	14	0.74	0.56-0.93	80	65-87	0.06	3.92
	No	18	0.99	0.78-1.19	68	42-79		2.82
Type of therapy	CBT	22	0.85	0.69-1.01	75	60-82	0.71	3.35
	Other	10	0.91	0.63-1.19	76	50-86		3.10
Format of therapy	Individual	12	0.89	0.68-1.10	63	17-79	0.28	3.18
	Group	15	0.94	0.69-1.20	81	68-87		2.99
	Other	5	0.64	0.35-0.94	78	27-89		4.63

BDI – Beck Depression Inventory, HAM-D – Hamilton Rating Scale for Depression, NNT – numbers-needed-to-be-treated, CBT – cognitive behavior therapy

NNT=1.99; I^2=93; 95% CI: 89-95). For the BDI-I, it was g=1.33 (95% CI: 0.54-2.12; n=9; NNT=2.06; I^2=93; 95% CI: 90-95); for the BDI-II, it was g=1.37 (95% CI: 0.76-1.97; n=7; NNT=2.01; I^2=91; 95% CI: 85-94).

Nine studies were potential outliers[39,47,49-51,53,55,58,59]. After exclusion of these studies, the effects dropped to g=0.95 (95% CI: 0.82-1.08; NNT=2.95). Heterogeneity was still moderate (I^2=55; 95% CI: 23-70). There were three potential outliers with extremely high effect sizes (g>2.0)[39,51,58]. The pooled effect size after excluding these extreme outliers was g=0.87 (95% CI: 0.73-1.06; I^2=78; 95% CI: 69-83).

In this meta-analysis, we included three studies in which two psychological treatments were compared with the same control group. This means that multiple comparisons were included in the same analysis, which may have resulted in an artificial reduction of heterogeneity and may have affected the pooled effect size. We examined the possible effects of this by conducting an analysis in which we included only one effect

Table 3 Psychotherapies for adult depression in Western and non-Western countries compared with control conditions

		N	g	95% CI	I^2	95% CI	p	NNT
	Western	291	0.60	0.55-0.64	59	53-64	<0.001	4.99
	Non-Western	32	0.87	0.73-1.02	78	69-83		3.26
Region	North America	165	0.67	0.59-0.74	61	53-67	<0.001	4.39
	Europe	107	0.51	0.45-0.57	47	32-58		6.01
	Australia	19	0.62	0.38-0.85	74	56-82		4.80
	East Asia	17	0.83	0.64-1.02	77	61-84		3.44
	Middle East and North Africa	6	1.17	0.69-1.65	74	18-87		2.35
	South Asia	3	0.86	0.47-1.25	77	0-91		3.30
	Other	6	0.73	0.30-1.16	85	64-91		3.98
Income level of country	High	297	0.60	0.55-0.65	59	54-64	0.002	4.99
	Upper middle	20	0.92	0.74-1.11	76	61-83		3.06
	Low/lower middle	6	0.83	0.44-1.22	88	76-93		3.44
Income level of country	High, Western	289	0.59	0.55-0.64	58	53-63	0.003	5.08
	High, non-Western	8	0.86	0.48-1.23	71	24-84		3.30
	Upper middle[a]	18	0.93	0.73-1.12	78	64-85		3.02
	Low/lower middle	6	0.83	0.44-1.22	88	76-93		3.44

[a]Turkey was excluded from this analysis because it is a Western country but also an upper middle-income one
NNT – Numbers-needed-to-be-treated

size per study. First, we included only the comparisons with the largest effect size from these studies and then we included only the smallest effect sizes. As can be seen from Table 2, the resulting effect sizes were almost the same as in the overall analyses. Heterogeneity was still very high in these analyses.

Visual inspection of the funnel plot, as well as Duval and Tweedie's trim and fill procedure, pointed at considerable publication bias. After adjustment for publication bias, the mean effect size was reduced from g=1.10 to g=0.73 (95% CI: 0.51-0.96; number of missed studies: 9). Egger's test also pointed at significant asymmetry of the funnel plot (p=0.004; intercept: 2.42; 95% CI: 0.65-4.20).

In the subgroup analyses, excluding the extreme outliers, we found that the risk of bias was significantly associated with the effect size (p<0.001). The six comparisons with the lowest risk of bias (no risk of bias for any of the four items of the assessment tool) had an effect size of g=0.51 (95% CI: 0.34-0.69; NNT=6.01) compared to g=1.20 (95% CI: 0.84-1.56; NNT=2.29) in the studies with the highest risk of bias.

We also found that the type of control group was significantly associated with the effect size, with care-as-usual control groups resulting in higher effect sizes than waiting list and other control groups (p=0.02).

None of the other subgroup analyses resulted in significant differences between subgroups, and that included the region (East Asia, Middle East and North Africa, South Asia, other), the level of income of the country (high, upper middle, low/lower middle), and whether or not the treatment was adapted to the local situation.

We conducted a series of bivariate meta-regression analyses. In these analyses, we found no indication that the effect size was significantly associated with the GNI (coefficient: 0.00; 95% CI: −0.00 to 0.00; p=0.56), the number of treatment sessions (coefficient: 0.00; 95% CI: −0.04 to 0.04; p=1.00), and year of publication (coefficient: 0.00; 95% CI: −0.03 to 0.04; p=0.84).

Comparison between the effects of psychotherapy in Western vs. non-Western countries

We considered the 32 comparisons from non-Western countries vs. the 291 comparisons from Western countries (Table 3; extreme outliers with g>2.0 were excluded from these analyses). We found that the effect size in Western countries (g=0.60; 95% CI: 0.55-0.64; I^2=59; 95% CI: 53-64; NNT=4.99) was significantly lower than in non-Western countries (p<0.001).

We also examined the effect sizes in the different regions and found that they differed significant across regions (p<0.001), with the lowest effect sizes in North America, Europe and Australia, and the highest in East Asia, South Asia and the Middle East and North Africa. We also found a significant difference across countries with different incomes, with the highest effect sizes in low- and middle-income countries.

Table 4 Standardized regression coefficients of characteristics of studies on psychotherapies for depression in Western and non-Western countries (full multivariate meta-regression analyses, excluding extreme outliers)

		Coeff	SE	p	Coeff	SE	p	Coeff	SE	p
Western vs. non-Western countries		0.26	0.08	<0.001						
Region	North America				Ref					
	Europe				−0.02	0.06	0.83			
	Australia				0.08	0.10	0.44			
	East Asia				0.17	0.11	0.11			
	Middle East and North Africa				0.44	0.18	0.02			
	South Asia				0.44	0.20	0.03			
	Other				0.25	0.16	0.11			
Income level of country	High							Ref		
	Low/lower middle							0.43	0.15	0.004
	Upper middle							0.31	0.10	0.002
Diagnosis vs. cut-off		−0.02	0.05	0.63	−0.01	0.05	0.88	−0.01	0.05	0.83
Target group	Unselected adults	Ref			Ref			Ref		
	Older adults	−0.05	0.07	0.52	−0.04	0.08	0.56	−0.04	0.07	0.55
	Women with PPD	−0.04	0.08	0.65	−0.04	0.08	0.61	−0.04	0.08	0.58
	General medical disease	0.04	0.07	0.57	0.04	0.07	0.60	0.04	0.07	0.53
	Other	0.05	0.07	0.45	0.03	0.07	0.64	0.06	0.07	0.38
Type of therapy	CBT	Ref			Ref			Ref		
	IPT	−0.08	0.09	0.39	−0.07	0.09	0.44	−0.09	0.09	0.33
	PST	−0.03	0.10	0.75	−0.02	0.10	0.84	−0.03	0.09	0.73
	Supportive	0.03	0.11	0.81	0.05	0.11	0.67	0.05	0.11	0.65
	Other	0.02	0.06	0.75	0.03	0.06	0.64	0.02	0.06	0.72
Format of therapy	Individual	Ref			Ref			Ref		
	Group	−0.10	0.06	0.08	−0.10	0.06	0.07	−0.12	0.06	0.03
	Guided self-help	0.05	0.07	0.53	0.04	0.08	0.57	0.03	0.07	0.67
	Other/mixed	−0.17	0.10	0.09	−0.15	0.10	0.13	−0.18	0.10	0.07
Number of sessions (continuous)		−0.00	0.01	0.68	0.00	0.01	0.54	0.00	0.01	0.65
Risk of bias (continuous)		−0.12	0.02	<0.001	−0.12	0.02	<0.001	−0.12	0.02	<0.001
Control group	Waiting list	Ref			Ref			Ref		
	Care as usual	−0.09	0.06	0.14	−0.10	0.06	0.13	−0.11	0.06	0.08
	Other	−0.21	0.07	<0.01	−0.23	0.07	<0.001	−0.23	0.07	<0.001
Intercept		1.01	0.10	<0.001	1.00	0.10	<0.001	1.03	0.10	<0.001
R^2 analog		0.36			0.36			0.38		

Coeff – regression coefficient, Ref – reference group, PPD – post-partum depression, CBT – cognitive behavior therapy, IPT – interpersonal psychotherapy, PST – problem solving therapy

In addition, we conducted a separate subgroup analysis in which we separated high-income countries into Western and non-Western countries (Table 3). We found that the eight studies in high-income, non-Western countries resulted in an effect size of g=0.86 (95% CI: 0.48-1.23; NNT=3.30; I^2=71; 95% CI: 24-84) compared to g=0.59 in Western countries (Table 2). A direct comparison between high-income countries in Western and non-Western countries did not indicate a significant difference (p=0.17), but this may have been related to the small number of studies from high-income non-Western countries.

We conducted a series of multivariate meta-regression analyses with the effect size as dependent variable (Table 4). In the first analysis, we included a dummy variable indicating whether the study was conducted in a Western or non-Western country, and also included other variables of the participants (a diagnosis of depression versus scoring above a cut-off on a self-report scale; the target group), the therapies (type,

Table 5 Standardized regression coefficients of characteristics of studies on psychotherapies for depression in Western and non-Western countries (parsimonious multivariate meta-regression analyses)

		Coeff	SE	p	Coeff	SE	p	Coeff	SE	p
Western vs. non-Western countries		0.23	0.07	<0.001						
Region	North America				Ref					
	Europe				−0.01	0.06	0.91			
	Australia				0.08	0.10	0.42			
	East Asia				0.13	0.10	0.21			
	Middle East and North Africa				0.43	0.17	0.01			
	South Asia				0.40	0.19	0.04			
	Other				0.22	0.15	0.15			
Income level of country	High							Ref		
	Low/lower middle							0.36	0.14	0.01
	Upper middle							0.24	0.09	0.01
Risk of bias (continuous)		−0.10	0.02	<0.001	−0.10	0.02	<0.001	−0.11	0.02	<0.001
Control group	Waiting list	Ref			Ref			Ref		
	Care as usual	−0.12	0.05	0.02	−0.12	0.05	0.02	−0.13	0.05	0.02
	Other	−0.23	0.06	<0.001	−0.25	0.06	<0.001	−0.25	0.06	<0.001
Intercept		0.98	0.05	<0.001	0.98	0.06	<0.001	0.99	0.05	<0.001
R^2 analog		0.37			0.37			0.38		

Coeff – regression coefficient, Ref – reference group

treatment format, number of sessions) and characteristics of the studies (type of control group and risk of bias). Whether the study was conducted in a Western or non-Western country remained a significant predictor of the effect size after adjusting for all other characteristics of the participants, interventions and studies ($p<0.001$).

In the second meta-regression analysis we used the same predictors, except that the dummy variable indicating that the study was conducted in a Western vs. a non-Western country was removed, and instead we added the variable indicating the region where the study was conducted. We found that studies conducted in the Middle East and North Africa, and in South Asia had significantly higher effect sizes than the reference group (studies from the United States).

In the third meta-regression analysis, we included the income of the country as predictor, and we found that both studies conducted in upper middle- ($p=0.002$) and in low/lower middle-income countries ($p=0.004$) had significantly higher effect sizes than those in high-income countries, while adjusting for all other variables.

We did not include the dummies indicating Western versus non-Western countries, the regions and the income level in one analysis, because the overlap across these variables was considered too large.

To avoid overfit of the meta-regression models, we repeated the above three meta-regression analyses with a (manual) stepwise backward elimination of the least significant predictor until only significant predictors remained in the model. The results of these parsimonious analyses are presented in Table 5. As can be seen, in all three models, risk of bias and type of control group remained significant, as well as the dummies indicating Western vs. non-Western countries, the regions and the income level.

DISCUSSION

Our study documents that psychotherapies for depression that have been developed in Western countries are also effective in non-Western countries. We even found indications that these therapies may be more effective in non-Western than in Western countries. This finding remained significant in multivariate meta-regression analyses in which we controlled for characteristics of the participants, the interventions and the studies.

We classified these studies in different ways, one in which we simply differentiated between Western and non-Western countries, one in which we categorized the countries into the major regions of the world according to the World Bank, and one in which we classified the countries according to their income (high, upper middle and low/lower middle). We found that the studies in non-Western countries had better outcomes than those from Western countries; that the effect sizes were

especially high in the Middle East and North-Africa, and in South Asia (although the lack of statistical significance for other regions may be caused by lack of power) and that studies in upper middle- and low/lower middle-income countries resulted in significantly higher effect sizes than studies in high-income countries.

It is not clear why the studies in non-Western countries had better outcomes. It is possible that these therapies simply work better in (some) non-Western countries, but it is not clear why that would be the case. Another explanation could be that most studies in non-Western countries had care-as-usual control groups, and that care-as-usual in these cases simply means to get no treatment at all, while in Western countries care-as-usual implies that patients have access to several treatments, like regular care provided by general practitioners or specialized mental health services. Another explanation could be that the quality of the studies conducted in non-Western countries was not optimal. Risk of bias was low in only 6 of the 32 included comparisons, and these studies with low risk of bias had considerably lower effect sizes than those with higher risk, very comparable to the ones found in Western countries.

We did not find indications that a specific adaptation of the treatment to the context where the therapy was conducted was associated with better outcomes. This finding should be considered with caution, because the description of the intervention was very brief in most papers, so that it cannot be excluded that the interventions were still adapted although this was not mentioned in the paper.

These findings do suggest that psychotherapies developed in Western countries can be implemented in non-Western countries when sufficient resources are available and without culturally adapting them. It has been argued recently that an investment in mental health care in low- and middle-income countries has considerable economic support[5]. Because we found no indication that the effects are associated with the treatment format, it would be possible to introduce low intensity interventions as a first line treatment, because these are easier and cheaper to implement than high intensity ones.

This study has several limitations that have to be taken into account when interpreting the results. One important limitation is that we may have missed studies because our searches mainly focused on Western databases, while studies published in other languages were not directly accessible. That implies that our results may be distorted because of bias in the selection of studies. Another limitation is that the quality of most of the included studies was not optimal, and only a handful of them had a high quality. Furthermore, these high-quality studies found considerably smaller effect sizes than the others, suggesting that the true effects are probably smaller than we found. However, after adjustment for study quality, studies in non-Western countries were still had better outcomes than those in Western countries. Another limitation is that most studies in non-Western countries were conducted in a selected sample of countries in Asia, and only few in Africa and Latin America.

Despite these limitations, this study suggests that psychotherapies developed in Western countries may or not be more effective in non-Western countries, but are probably no less effective and can therefore also be used in these latter countries, regardless of their income level.

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